

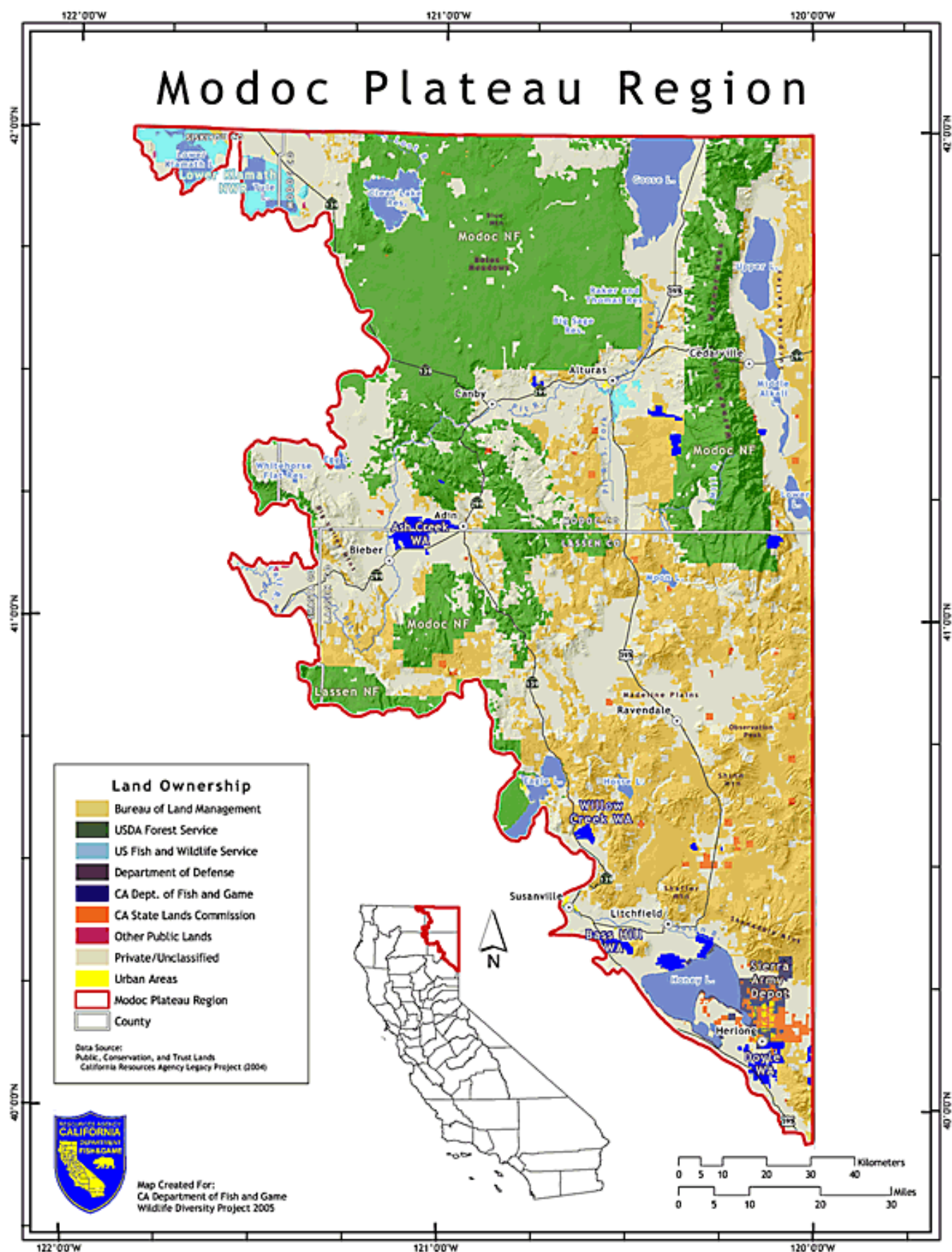
12 Modoc Plateau Region ~~~~

I. Overview

The Modoc Plateau Region is located in the northeastern corner of the state, framed by and including the Warner Mountains and Surprise Valley along the Nevada border to the east and extending west to the edge of the southern Cascades Range. The region extends north to the Oregon border and south to include the Skedaddle Mountains and the Honey Lake Basin.

A million years ago, layered lava flows formed the 4,000–5,000-foot elevation Modoc Plateau, separating the watersheds of the region from the Klamath drainage to the northwest. The waters of the western slope of the Warner Mountains and the Modoc Plateau carved a new course, the Pit River, flowing to the southwest through the Cascades and joining the Sacramento River.

Situated on the western edge of the Great Basin, the Modoc Plateau historically has supported high desert plant communities and ecosystems similar to that region—shrub-steppe, perennial grasslands, sagebrush, antelope bitterbrush, mountain mahogany, and juniper woodlands. Sagebrush plant communities are characteristic of the region, providing important habitat for sagebrush-dependent wildlife. Conifer forests dominate the higher elevations of the Warner Mountains and the smaller volcanic mountain ranges and hills that shape the region. Wetland, spring, meadow, vernal pool, riparian, and aspen communities scattered across the rugged and otherwise dry desert landscape support diverse wildlife. The region has varied aquatic habitats, from high mountain streams to the alkaline waters of Goose Lake and Eagle Lake to clear spring waters of Fall River and Ash Creek.



Northeastern California is an outstanding region for wildlife, providing habitat for mountain lion, mule deer, pronghorn, Rocky Mountain elk, greater sage-grouse, and the colorful waterfowl of the **Pacific Flyway** that funnel through the area during their annual migrations. Golden eagles, peregrine and prairie falcons, northern goshawks, sandhill cranes, and American white pelicans nest and hunt or forage in the region. The varied aquatic habitats and natural barriers along the Pit River and its tributaries have allowed the evolution of several unique aquatic communities that include **endemic** fish and invertebrates.

Sixty percent of the region is federally managed; the Forest Service manages 30 percent, BLM manages 26 percent, and the Fish and Wildlife Service and the Department of Defense each manage about 2 percent of the lands. State Fish and Game manages 1 percent of the region as wildlife areas. About 37 percent of the lands are privately owned or belong to municipalities.

Only 9 percent of the forests and rangelands of the Modoc region are designated as reserves, such as wilderness areas, less than is protected in other regions of the state except the Central Valley. The wilderness areas and refuges in the region are grazed by livestock (CDFFP 2003). The combined total of lands managed by State Parks and the National Park Service is about 2,500 acres.

Many of the region's plant communities and ecosystems have been substantially altered or degraded over the last 120 years by a combination of stressors. Despite being in one of the least-developed regions of the state, the sagebrush, perennial bunchgrass, aspen, bitterbrush, and mountain mahogany habitats of the Modoc Plateau are among the most threatened ecosystems of North America (TNC 2001). Aspen stands are in sharp decline (Di Orio et al. 2005). Many of the meadow and riparian areas are overgrazed or are suffering from encroachment by juniper, pine, fir, and invasive plants (Loft et al. 1998, USFS 2001, 1991b).

The major stressors negatively affecting terrestrial wildlife on the Modoc Plateau are a combination of livestock and feral horse grazing, invasive annual grasses, the expansion of native western juniper, and altered frequencies of fire. Together, these stressors have combined to alter the region's sagebrush and forest habitats and ecosystems (Miller et al. 1994, Schaeffer et al. 2003). Today, extensive season-long grazing continues to degrade and prevent recovery of riparian habitats, streams, and creeks. In the Warner Mountains, most riparian areas are not in good ecological condition (USFS 2000b). In the forested areas, the additional effects of timber-management practices that emphasize single species and even-aged tree stands negatively affect wildlife habitat. Aquatic ecosystems throughout the region are affected by water diversions, erosion from logging roads, grazing activities, and introductions of non-native fish and invertebrates.

Private land owners, state and federal land management agencies, resource conservation districts, watershed groups, and fishing and hunting organizations, working through various partnerships, are involved in stream, riparian, wetland, and upland restoration and conservation projects across the region.

2. Species at Risk

Northeastern California is particularly noted for its charismatic large mammals, sagebrush-dependent species, and waterfowl. By the 1920s, however, widespread hunting for marketable game and predator control that occurred in the years following the Gold Rush eliminated California bighorn sheep, elk, gray wolf, and grizzly bear. Pronghorn herds were decimated but not eliminated. The local extinction of sharp-tailed grouse is attributed to the conversion of lands to farming and ranching and the subsequent loss of riparian habitat (Shilling et al. 2002, Williams 1986). Native species once abundant in the region, like greater sage-grouse and other sagebrush-associated species, have declined dramatically over the last several decades (McAdoo et al. 2002, Monsen and Shaw 2000). Native fish and aquatic invertebrates, including endemic Modoc sucker, the Lost River sucker, shortnose sucker, redband trout, and Shasta crayfish, are affected by sediment runoff and altered river flows and are displaced by introduced species through predation or ecological competition.

These are the more well-known species affected by human activities. Unfortunately, due to lack of interest and lack of information, less is known about how hundreds of other animal species have fared over the past decades.

The Plan development team updated vertebrate and invertebrate species information in the California Natural Diversity Database (CNDDB) during 2004–2005. The following regional summary of numbers of wildlife species, endemic species, and **species at risk** is derived from the updated CNDDB.

There are 399 vertebrate species that inhabit the Modoc Plateau region at some point in their life cycle, including 235 birds, 97 mammals, 23 reptiles, six amphibians, and 38 fish. Of the total vertebrate species that inhabit this region, 57 bird **taxa**, 21 mammalian taxa, three reptilian taxa, one amphibian taxon, and 20 fish taxa are included on the **Special Animals List**. Of these, three are endemic to the Modoc Plateau region, one is endemic to California but introduced to this region, and three species found here are endemic to California but not restricted to this region (Table 12.1).

Table 12.1: State-Endemic Special Status Vertebrates of the Modoc Plateau Region

+	<i>Archoplites interruptus</i>	Sacramento perch
	<i>Cottus asperimus</i>	Rough sculpin
	<i>Cottus klamathensis macrops</i>	Bigeye marbled sculpin
*	<i>Gila bicolor ssp. I</i>	Eagle Lake tui chub
*	<i>Gila bicolor vaccaceps</i>	Cow Head Lake tui chub
	<i>Mylopharodon conocephalus</i>	Hardhead
*	<i>Oncorhynchus mykiss aquilarum</i>	Eagle Lake rainbow trout

* denotes taxon is endemic to region

+ denotes taxon is endemic to California but introduced in this region

The number of arthropod species is so great, and they are so poorly known taxonomically, that it is presently impossible to accurately estimate the total number of invertebrate species occurring in the state. In the Modoc Plateau region, however, 11 invertebrate taxa are included on the Special Animals List, including one arthropod taxon and 10 mollusk taxa. Of these, one is endemic to the Modoc Plateau region, and four other taxa found here are endemic to California but not restricted to this region (Table 12.2).

Table 12.2: State-Endemic Special Status Invertebrates of the Modoc Plateau Region

<i>Colligyrus convexus</i>	Canary dusksnail
<i>Lanx patelloides</i>	Kneecap lanx
<i>Pacifastacus fortis</i>	Shasta crayfish
* <i>Pyrgulopsis cinerana</i>	Ash Valley pyrg
<i>Pyrgulopsis eremica</i>	Smoke Creek pyrg

* denotes taxon is endemic to region

The Wildlife Species Matrix, including data on listing status, habitat association, and population trend for each vertebrate and invertebrate species included on the Special Animals List, is available on the Web at http://www.dfg.ca.gov/habitats/wdp/matrix_search.asp. For vertebrates, the matrix also includes links to species-level range maps. Additionally, a link to the California Department of Fish and Game's online Field Survey Form is available to assist in reporting positive sightings of species on the Special Animals List to the California Natural Diversity Database (CNDDB).

Two Species at Risk

Note: The following discussion of two species at risk illustrates how stressors or threats affect species and highlights conservation challenges and opportunities. These species discussions are not intended to imply that conservation should have a single-species approach.

The story of the greater sage-grouse illustrates how the alteration by multiple stressors of native plant communities in the region has caused the decline of species associated with those native plant communities. The struggle to reintroduce bighorn sheep to northeastern California highlights how multiple uses of wildlands may not be compatible with wildlife and healthy ecosystems.

Greater Sage-Grouse

The colorful and charismatic greater sage-grouse is sought by birders and is a popular game bird. Its long-term survival is a high priority for wildlife managers in northeastern California. A long-lived upland bird with a low reproductive rate, the greater sage-grouse is completely dependent on the sagebrush habitats of western states.

The greater sage-grouse has specific habitat requirements. It needs open areas among sagebrush and other shrubs, away from tall trees, utility poles, or other features that offer perches to predators like ravens and raptors (Connelly et al. 2004, BLM 2000). Seasonally, they gather in leks, or breeding display sites. Leks are very specific locations and typically occur in open areas surrounded by sagebrush. Lek sites are used year after year, unless the habitat is altered or destroyed. Each lek has from 10 to 100 or more male birds that will exhibit brilliant strutting displays to attract females for breeding.

Sage-grouse were once abundant on the Modoc Plateau, but owing to habitat degradation, it is a species of concern in the region. Sage-grouse have declined in numbers as sagebrush habitat has been transformed by livestock grazing, the invasion of exotic grasses, increased fire frequency at lower elevations, and expansion of western juniper at higher elevations. Grouse habitat also has been degraded by roads, fences, utility poles, and land development (Connelly et al. 2004, Dobkin 1995, NDOW 2004, Nelle et al. 2000). Lek sites are abandoned where western juniper has become dominant. Sage-grouse are also sensitive to disturbances such as off-road vehicles and development. (See Fig. 12.1, Greater Sage-Grouse Current and Historical Range.)

In the 1940s there were 46 active leks and thousands of sage-grouse utilizing Devil's Garden—the rugged lava-rock-strewn shrub-steppe between Goose Lake and Tule Lake. In 2002, there were only two leks with just 16 male birds in the Devil's Garden (Hall 2002).

The greater sage-grouse is the flagship species of the multistate effort to restore sagebrush habitats of the West. The Greater Sage-Grouse Conservation Plan for Nevada and Eastern California, published in June 2004, is the result of a four-year cooperative effort by stakeholders in California and Nevada (NDOW 2004). Its purpose is to ensure that, to the greatest extent feasible, sage-grouse populations and their habitat are maintained, enhanced, or restored on public lands and that such activities are promoted on private lands. Restoration of sagebrush habitats would benefit numerous other sagebrush-dependent species as well, like the sage sparrow, sage thrasher, the Brewer's sparrow, the pygmy rabbit, and the pronghorn. Each will benefit from a plan that conserves and protects complex sagebrush-dominated habitats (McAdoo et al. 2002). Also, BLM has produced the Greater Sage-Grouse and Sage-Steppe Ecosystems Management Guidelines as a guide for land managers (BLM 2000).

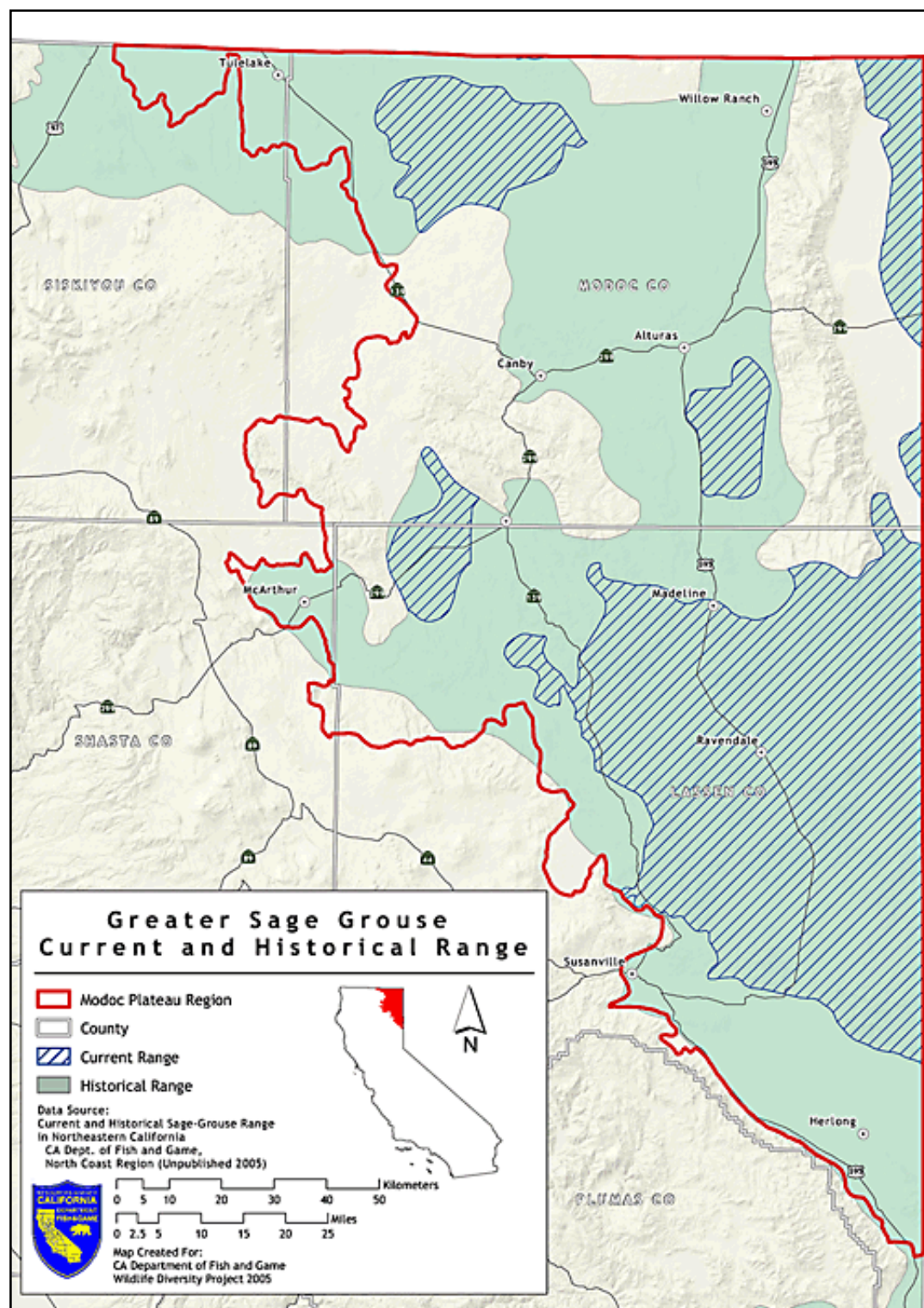


Fig. 12.1: Greater Sage-Grouse Current and Historical Range

Greater sage-grouse range has declined as sagebrush habitat has been transformed by livestock grazing, the invasion of exotic grasses, changes in fire frequency, and expansion of western juniper.

California Bighorn Sheep

California bighorn sheep are native to northeastern California but were extirpated from the region by 1922. Domestic sheep-grazing on public lands and on adjacent private lands has defeated efforts to re-establish bighorn sheep in the Modoc Plateau Region. The threat of disease transmitted from domestic sheep is the primary reason bighorn sheep have not been reestablished in several ranges of northeastern California (Bleich et al. 1996, Krausman et al. 1996, NCBSIAG 1991).

Fish and Game has attempted to reintroduce bighorn sheep to the area. In 1971, 10 sheep were captured in British Columbia and released in the Lava Beds National Monument, a site near the western edge of the Modoc Plateau Region. For nine years, the Lava Beds bighorn progressed well, expanding their numbers to 43 by 1979. In the winter of 1980, four bighorn sheep were moved from the Lava Beds to the Warner Mountains to join 10 bighorn sheep transferred from the southern Sierra. The Warner Mountains turned out to be particularly good habitat for bighorn sheep. Between 1980 and 1987, no lamb mortality was documented, and by 1987 the Warner's bighorn numbers had grown to about 60 animals. But exposure to domestic sheep on public grazing allotments and on adjacent private lands led to a complete die-off of bighorn sheep at both sites. In the summer of 1980, the remaining sheep in the Lava Beds succumbed to pneumonia, attributed to contact with domestic sheep. The complete die-off of the Warner bighorn herd in 1988 was also attributed to disease derived from domestic sheep (Bleich et al. 1996, NCBSIAG 1991, Siperek 2004 pers. comm., USFS 1991a).

The historical range of the Warner Mountains and the Lava Beds provides ideal habitat for bighorn sheep. However, the continued presence of domestic sheep on public and private lands in or adjacent to these areas makes new efforts to reintroduce bighorn sheep to these areas not practical at this time. The Amedee and Skedaddle Mountains, 25 miles east of Susanville, have also been identified as excellent range for bighorn sheep in northeastern California. While under consideration for two decades, the reintroduction of bighorn sheep to the Amedee and Skedaddle Mountains has not been implemented largely because of continued grazing of domestic sheep in this area (Armentrout 2004 pers. comm., Bleich 2004 pers. comm., NCBSIAG 1991).

3. Stressors Affecting Wildlife and Habitats

- Excessive livestock grazing
- Excessive feral horse grazing
- Altered fire regimes
- Western juniper expansion
- Invasive plants
- Forest management conflicts
- Water management conflicts and degradation of aquatic ecosystems

Excessive Livestock Grazing

The effects of grazing on wildlife vary from beneficial to detrimental, depending upon how grazing is managed, including the seasonality and duration of grazing and the type and number of livestock. These effects also depend on the relative sensitivities of individual wildlife species, since not all species respond the same way to grazing. Well-managed livestock grazing can benefit sensitive plant and animal species, particularly by controlling annual grasses and invasive plants where these have become established. These working lands are an essential part of the solution to conserving the state's wildlife.

While recognizing the values of appropriate grazing practices, this plan is required to focus on stressors affecting wildlife species at risk. Thus, the following discussion describes those situations where excessive grazing practices stress wildlife species at risk. Excessive grazing, as used here, refers to livestock grazing at a frequency or intensity that causes degradation of native plant communities, reduces habitat values for native wildlife species, degrades aquatic or other ecosystems, or impairs ecosystem functions. (The term "overgrazing" has a different meaning; it is usually used in referring to the productivity of the forage crop and range condition).

Livestock production is a major economic activity of northeastern California. The Modoc Plateau and the adjacent forested lands have been grazed since the late 1800s. While livestock grazing practices have improved over the last few decades, excessive grazing continues to degrade riparian plant communities and aquatic ecosystems in the region (USFS 1991b, 2000b, 2001b). Today, there are very few areas in the region that are not grazed; grazing allotments cover nearly all public forest and rangelands that can support large herbivores. (See Fig. 12.2.) For example, the Warner Mountain range is currently managed as rangeland for cattle and sheep, with 28 grazing allotments covering nearly the entire landscape, including much of the South Warner Wilderness Area (USFS 2000b). Livestock in the region are typically grazed on private lands in the winter and moved to BLM and Forest Service lands in the spring and summer (Roush 2005 pers. comm.). In the Modoc National Forest, there are 122,000 **Animal Unit Months** (AUMs) allocated for livestock, 20,000 AUMs for wildlife, and 4,000 AUMs for horses. (An Animal Unit Month is the amount of forage necessary to support one horse, one steer or a cow and calf, or five sheep for one month). On BLM land in the region there are about 55,000 AUMs allocated for livestock.

Excessive livestock grazing has both short-term and long-term impacts. Seasonally, grazing reduces available herbaceous vegetation required by native herbivores, and it reduces nesting- and escape cover for birds and other wildlife. As upland grasses and forbs dry in the summer, livestock grazing intensifies around riparian and meadow habitats, and browsing shifts to other higher-protein sources such as bitterbrush, mountain mahogany, and aspen; annual bitterbrush leaders and willow and aspen shoots are consumed (Loft et al. 1998, Menke et al. 1996, USFS 1991b, Young and Clements 2002b). Heavy grazing removes vegetation and causes erosion along springs, creeks, meadows, and riparian corridors of the Modoc Plateau Region (Hall 2004 pers. comm., Moyle 2002).

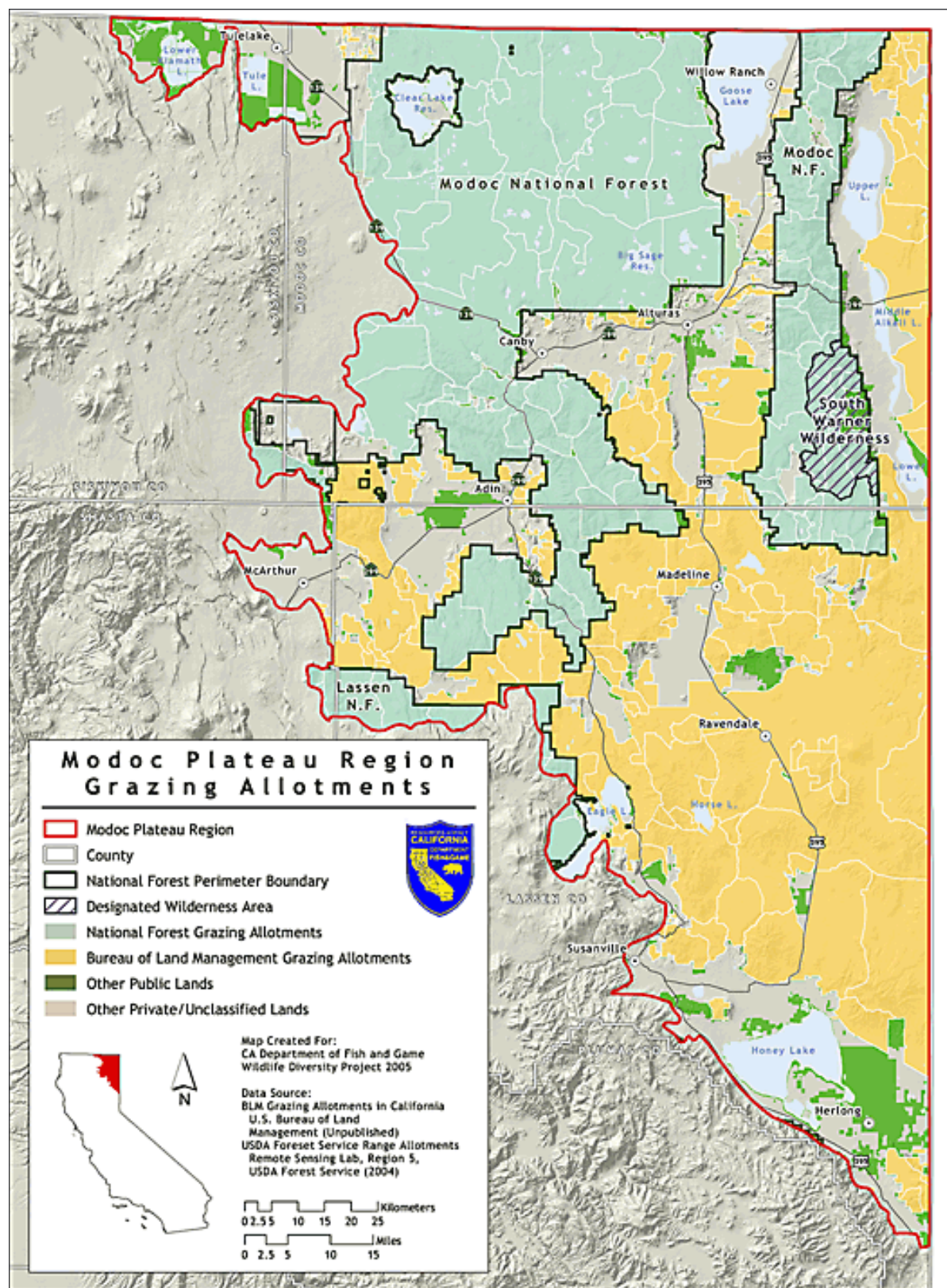


Fig. 12.2: Modoc Plateau Region Grazing Allotments

Livestock grazing allotments cover nearly the entire Modoc Plateau Region. Very little area is managed primarily for the benefit wildlife and habitat.

Decades of excessive livestock grazing have also contributed to long-term ecosystem and habitat changes in the region. Since the late 1800s, overgrazing has triggered changes in composition and abundance of grasses, herbs, shrubs, and tree species. Livestock carried seeds of invasive species into the region. Grazing pressure created conditions for invasive grasses to outcompete native species and facilitated shrub growth over perennial grasses. Exotic annual grasses, particularly cheatgrass, carpet the landscape with fine fuels conducive to more frequent fires in shrub-grass plant communities (Pellent 1996 and 2002). Intentional clearing of sagebrush stands to improve range conditions for livestock also contributed to the transformation of shrub habitats. This combination of grazing-associated stressors has caused landscape-level changes, resulting in steep declines in the sagebrush, bitterbrush, and mountain mahogany plant communities that once supported abundant populations of greater sage-grouse and other shrub-dependent species. Grazing has also degraded wildlife habitat in areas like the sagebrush steppe on the Devil's Garden, the forestlands of the Warner Mountains, and the forest meadows throughout the region, reducing habitat values for native species (Menke et al. 1996, Miller et al. 1994, Schaeffer et al. 2002, Young and Clements 2002b).

Reduced fire frequency and livestock grazing throughout the growing season have contributed to the decline of aspen communities in the region. Livestock, in addition to deer and elk, consume aspen suckers and shoots and compact soft soils, preventing the successful regeneration of aspen stands. Like riparian habitats, aspen stands represent a small area of the landscape, but they are very important for supporting wildlife diversity. The multilayered vegetative aspen understory of herbs, shrubs, and woody debris provides abundant food and shelter for wildlife. Cottontail rabbit, snowshoe hare, porcupine, beaver, mule deer, blue grouse, quail, flycatchers, bluebirds, and Northern goshawk are among the animals that utilize and rely on aspen communities (Burton 2002, Loft et al. 1987).

Riparian and aquatic ecosystems are particularly affected by livestock grazing today (USFS 1991b, 2001b). These impacts are discussed under the Water Management Conflicts and Degradation of Aquatic Ecosystems section.

Excessive Feral Horse Grazing

While grazing by feral horses is very limited compared to cattle and sheep grazing in the region, it adds to the total impact of livestock and wildlife grazing. Since the arrival of settlers in the late 1800s, horses have escaped or been released, and today horses roam as feral herds throughout the Modoc Plateau Region. More than 2,300 feral horses graze year-round in northeastern California and border areas of Nevada on BLM and Forest Service land in eight Herd Management Areas (HMAs). Feral horses graze riparian and aquatic plant communities in late season, when these habitats are most vulnerable to damage (Beever 2003). One of the largest herds in the region is on the Modoc National Forest's 236,000-acre Devil's Garden Wild Horse Territory (WHT), overlapping 10 livestock-grazing allotments. Many of the Devil's Garden horses are descendants of draft horses, large animals with big

hooves (Pasero 2004 pers. comm.). The heavier animals consume more forage and likely cause more trampling damage to delicate soils and creek beds than smaller horses.

For each Herd Management Area and the Wild Horse Territory, BLM and the Forest Service have established an “Appropriate Management Level” (AML), the target number of animals that the land management agencies have decided is appropriate for an area to achieve a “thriving natural ecological balance” (BLM July 2004). However, a “thriving natural ecological balance” has not been defined based on scientific principles or ecological criteria. Nor have ecological indicators been identified that could be monitored to assess when “natural ecological balance” is achieved.

The BLM and the Forest Service committed significant resources to maintain horse numbers within the AMLs. However, feral horse numbers have routinely exceeded, sometimes by two- or threefold, the AMLs for the herd management units and the Wild Horse Territory. In August 2004, horse herd sizes in the eight herd management units in Northern California exceeded the AMLs by an average of 68 percent (BLM 2004a). The excessive horse numbers contribute to overgrazing in the region, leaving less forage for wildlife, degrading range condition, and adding to grazing impacts on seeps, springs, riparian habitat, and aspen stands.

For the past 30 years, the Forest Service, with the help of BLM, has struggled to maintain horse numbers in the Wild Horse Territory within the appropriate management levels. Horses are captured and adopted out. Some horses that are not adopted are returned to the public lands. The feral horse herds have been very productive, increasing in numbers by nearly 20 percent annually (Beever 2003, Pasero 2004 pers. comm., USFS July 2004). Horses must be gathered year after year to maintain herds within their AML. For example, the AML for the Wild Horse Territory is 305 horses. Thus, 60 to 75 animals must be permanently removed from the herd annually to maintain the herd near the target size of 305 animals. Costs for gathering horses have skyrocketed. From 1990 to 2002, the cost per horse for capture and adoption increased from \$350 to \$1,500. If horse numbers were within the target range for all the herds of northeastern California, it would require the capture and permanent removal of nearly 300 horses annually to maintain them within the BLM- and Forest Service-established appropriate management levels.

In August 2004, more than 800 horses grazed Devil’s Garden, exceeding the AML by 500 animals. Contracted by the Forest Service, BLM launched a two-week effort, utilizing a helicopter, large stock trucks, and hired wranglers in an attempt to gather 500 horses. Despite a very determined effort, only 174 horses were gathered. Additional weeks of helicopter flight-time, livestock truck rental, and hired crews would be required to reduce the herd size below 305 animals.

The lack of resources to maintain limited horse herd sizes means horses contribute to overgrazing of the region, whereby the combined grazing of livestock and horses far exceeds grazing levels that are compatible with maintaining wildlife diversity and abundance.

Table 12.3: Chronology of Horse Gathering in Devil's Garden Wild Horse Territory

1974	500 animals in WHT
1976–78	260 horses removed from WHT
1978–1979	Horse population rebounded to 1,000 animals
1979	Forest Service contracted BLM—388 excess horses were removed.
1985–1990	BLM removed 60 horses annually
1990	469 horses counted in WHT
1992–93	Rough winters reduced herd to 200 animals
1995–2001	BLM gathered 100 horses annually
2002	Herd exceeded 700 animals; BLM gathered 260, adopted out about 70 percent, and returned rest to WHT
2004 (August)	More than 800 horses in WHT; BLM gathered 174

Altered Fire Regimes

Fire is an ecologically important disturbance that shapes and maintains native plant communities and wildlife habitats. The frequency and intensity of fires is determined by the pattern and density of vegetation (fuel loading), landscape topography, fuel moisture, and long-term weather trends. In turn, fire affects ecological processes, the vegetative mosaic of the landscape, the structural diversity of habitats, and the accumulation of organic material. Specific plant communities or habitats have evolved within ranges of fire-return intervals. At higher elevations, natural wildlife habitats of northeastern California are adapted to specific fire-return intervals of between 12 and 30 years. At lower elevations and drier sites dominated by shrubs, with less dense fuel, natural fire return intervals may be 30 to 100 years (Brooks and Pyke 2001, Chang 1996, Young et al. 1988). However, for the past 150 years, land-use activities, native and non-native plant invasions, and fire suppression have increased or decreased fire frequencies, upsetting fire regimes and degrading habitat for native species (Arno and Fiedler 2005).

For example, in native shrub-grass communities, overgrazing in the years between the 1860s and the 1930s reduced native perennial grasses, providing conditions more beneficial to invasive annual grasses and to shrub expansion (Menke 2005 pers. comm.). The proliferation of flammable annual grasses led to increased fire frequency in many areas, reducing less fire-tolerant shrubs, such as big sagebrush, mountain mahogany and lower-elevation bitterbrush. More-frequent fire disturbance has facilitated

additional invasions of non-native plants, further transforming the plant community, which is now dominated by invasive grasses less suitable for native wildlife (Brooks and Pyke 2001, Hall 2004 pers. comm., McAdoo et al. 2002)

For other plant communities of the region, such as pine and fir forests, fire is critical for maintaining healthy ecosystems and habitat for native wildlife. These plant communities have evolved with fire, and, through adaptation, have developed traits that require fire. Some plants, like deerbrush, need fire for germination (Perry 1994). Other plants have accelerated their life cycles to complete development between fire intervals. Species have developed fire-resistant buds, twigs, and bark. Fire facilitates sprouting in some plants and seed release and flowering in others. Wildlife species are dependent on many plant species that require fire (Chang 1996, McKelvey et al. 1996, Skinner and Chang 1996).

Western Juniper Expansion

Livestock grazing between 1880 and 1930 likely facilitated the expansion of native western juniper. Grazing consumed fine fuels, decreasing fire frequency and reducing competition from herbaceous species. (This process began 30 to 50 years before invasive grasses increased fire frequencies in the early 1900s.) The reduced fire frequency allowed western juniper to expand its coverage into sagebrush, bitterbrush, mountain mahogany, riparian, and aspen plant communities (BLM 2000, Miller and Rose 1999). Juniper has flourished by outcompeting other vegetation for water and nutrients and altering ecosystems to such an extent that other once-abundant native plants and wildlife are now scarce in these areas. In the last 130 years, juniper has increased its coverage in the plant communities tenfold and now covers over 2.5 million acres of northeastern California (EOARC 2004, USFS July 2004). (See Fig. 12.3.) The expansion and increased density of this tree reduces shrubs, herbaceous cover, and plant diversity, decreasing habitat for shrub-affiliated native wildlife (Miller et al. 2000, Miller 2001). As juniper crowds out shrubs and **forbs**, ground- and shrub-nesting birds are absent or in low numbers. With the increase in juniper dominance and the decline of sagebrush communities on the Modoc Plateau, greater sage-grouse populations have plummeted.

There have been limited efforts to reduce western juniper to encourage the growth of shrubs and grass for forage. The Big Sage Fire Management Unit, which overlies portions of the Devil's Garden and Doublehead Forest Districts, has a fire plan that allows lightning-caused fires to burn with minimum suppression effort. This practice has reduced juniper on several hundred acres. Since 1980, the Doublehead Ranger District of the Modoc National Forest has removed about 150 acres per year of western juniper through firewood sales (USFS 1991a). The Cooperative Sagebrush Steppe Restoration Initiative, launched by a coordinated effort of BLM and the Forest Service, is preparing plans for landscape treatments to reestablish the shrub communities that are more important for wildlife. Reestablishing native shrubs and grasses where juniper now dominates is not as simple as cutting down or burning acres of juniper. Invasive annual grasses, rather than native plant communities, are likely to

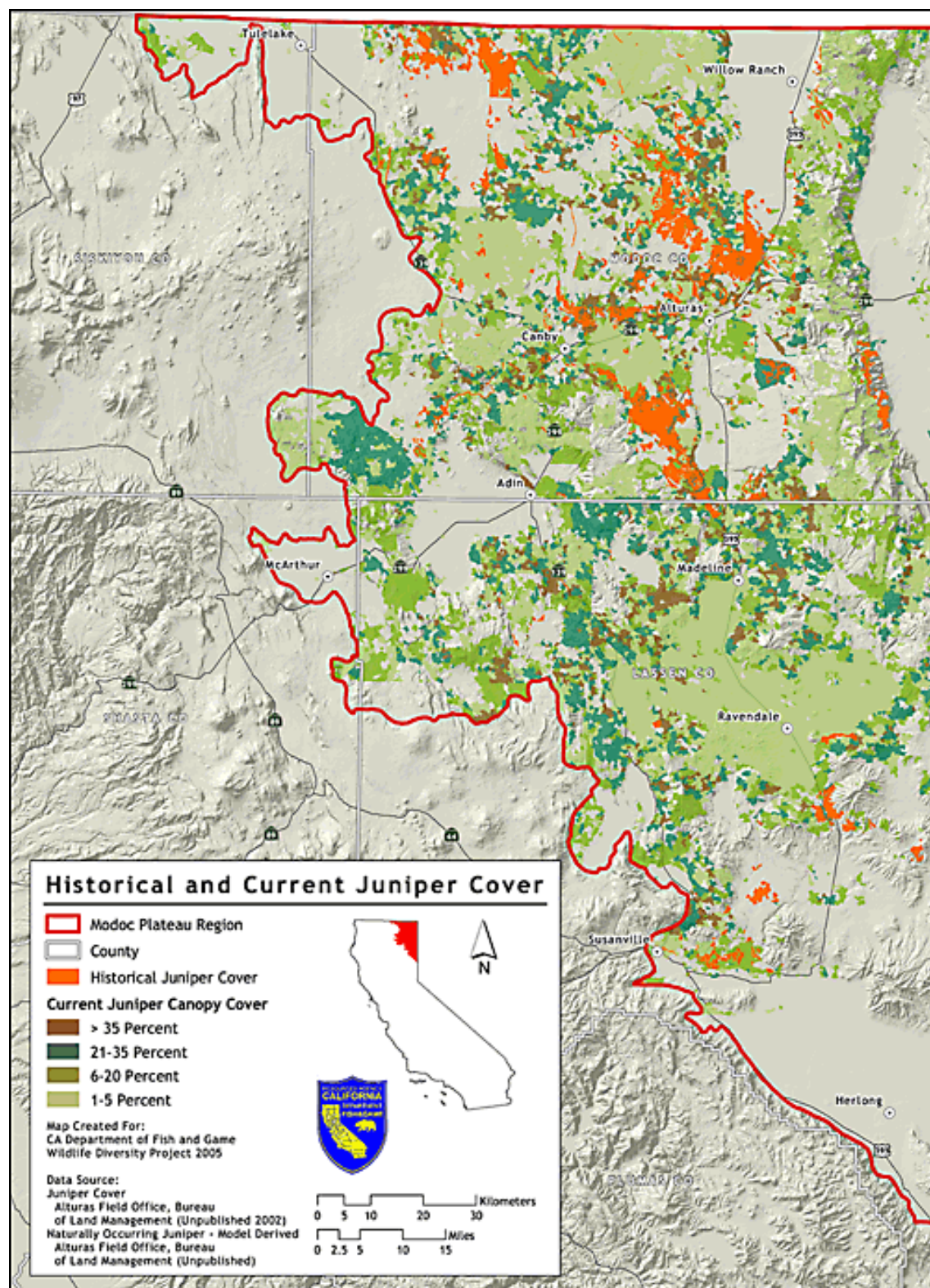


Fig. 12.3: Historical and Current Juniper Cover

The expansion of western juniper is replacing sagebrush and other plant communities. Naturally occurring western juniper was derived from a predictive model (using soil types, range boundaries, and topography) and is estimated to have covered 196,000 acres. Present-day extent of western juniper is estimated to be over 2.5 million acres.

replace the juniper unless conditions are appropriate to benefit the native plants. Conversion of juniper to alternate native plant communities will require careful field testing and analysis of results, followed up with **adaptive management** (Belsky 1996, Miller 2001).

Invasive Plants

Numerous exotic grasses and plants, like perennial pepper weed, annual medusahead, red brome, and various non-native thistles and aquatic weeds such as Eurasian watermilfoil, have displaced native plants and altered local plant communities. One species, cheatgrass, has had a particularly dramatic impact on native shrub and grassland communities. Native to southern Europe, North Africa, and southwestern Asia, cheatgrass was first dispersed in northeastern California sometime in the early 1900s, probably via contaminated grain seeds. Cheatgrass displaces native grasses and forbs by more effectively tapping soil moisture and hinders seedling establishment of native shrubs by reducing moisture and nutrients in surface soils (Norton et al. 2004). Once established and abundant, cheatgrass facilitates frequent fires by providing a carpet of fine fuels, which carry fire more efficiently than well-spaced native perennial grasses and native shrubs (Pellant 1996). Plant species slow to recolonize following fire, like bitterbrush and sagebrush, decline with increased fire frequencies. Cheatgrass has converted native vegetation to fire-prone grasslands, destroying sagebrush, bitterbrush, and mountain mahogany plant communities. The invasion of cheatgrass and other exotic plants has contributed to the wholesale conversion of thousands of acres of sagebrush, bitterbrush, and mountain mahogany plant communities to annual grasslands less supportive of native wildlife (Henstrom et al. 2002, Miller et al. 1994, Schaefer et al. 2003, Young 2000).

Forest Management Conflicts

Forest management practices, including even-aged tree production, road building, and fire suppression, significantly affect forest ecosystems and wildlife in the Modoc Plateau Region, as they do in the Sierra Nevada and Cascades. The U.S. Forest Service Sierra Nevada Framework Plan included the forests of the Modoc Plateau Region within its analysis of wildlife and habitat resources. Rather than repeat the forest discussion here, forest management stressors and conservation efforts in the Modoc region are discussed in Chapter 13, Sierra Nevada and Cascades Region.

Water Management Conflicts and Degradation of Aquatic Ecosystems

Many of the stressors affecting terrestrial habitats also combine to impact the aquatic ecosystems and species of northeastern California. Unique fish communities, native trout, amphibians, and invertebrates are at risk in aquatic systems throughout the region.

The 3-million-acre Pit River **watershed** is the major drainage of the Modoc Plateau, providing 20 percent of the water to the Sacramento River. The upper reaches of the watershed are in creeks of

the Warner Mountains that drain into Goose Lake. The north fork of the Pit River flows from Goose Lake southwest and merges with the south fork of the Pit River, which drains the southern Warner Mountains. The Pit River meanders across the plateau and farmlands, receiving the drainage of Ash Creek and the flows of Fall River and Hat Creek before weaving west across the southern Cascades range. The river is checked and held by several dams and reservoirs along the way but eventually drains into Lake Shasta. Unique fish and invertebrates have evolved in isolated springs and segments of the Pit River watershed. Fourteen native fish species are found in various associated fish communities in segments of the watershed's rivers and creeks. Endemic aquatic species inhabit the watershed, including the Modoc sucker, the Goose Lake redband trout, Goose Lake tui chub, Goose Lake lamprey, Cow Head Lake tui chub, and the Shasta crayfish (Ellis and Cook 2001, Moyle 2002).

Creeks of the northern Modoc Plateau (or Lost River watershed) drain to Clear Lake. The outlet of Clear Lake is the Lost River, which circles north into Oregon farmland and then joins the Klamath River system. The Lost River watershed has its own endemic aquatic fish and invertebrates.

In these watersheds, the effects of timber management practices (particularly erosion from logging roads), livestock grazing, and nutrient runoff from farms have degraded creeks and rivers, negatively affecting ecosystems that support aquatic and riparian species. Dams and diversions for hydroelectric power and agricultural diversions have disrupted normal flow patterns, increased water temperatures, and blocked spawning migrations. Dams have fragmented creeks and rivers, permanently isolating subpopulations of aquatic species such as the Shasta crayfish.

These stressors have degraded the main stem and tributaries of the Pit River. The State Water Resources Control Board lists the Pit River and Fall River as impaired—failing to meet state water quality standards. One hundred twenty-three miles of the Pit River fail to meet state water quality standards. Grazing and farm waste runoff have increased water temperature and polluted the river with excessive nutrients, lowering dissolved oxygen. Many Pit River tributaries suffer similar degradation from land-use practices (SWRCB 2002b).

Fall River emerges as spring water in the southern Cascades, receives the Bear Creek drainage, and then joins the Pit River. Fall River is known for its premiere wild trout fishery. However, sediment runoff from past land-use practices in the Bear Creek watershed has polluted Fall River (SWRCB 2002b).

The introduction of exotic aquatic species (e.g., largemouth bass and non-native trout to lakes, and bullheads, catfishes, and signal crayfish to rivers and streams), has reduced or extirpated populations of native amphibians and fish and affected invertebrates in many segments of the rivers, creeks and lakes of the region.

Restoring and protecting aquatic, riparian, meadow, and aspen habitats is among the highest priorities for northeastern California to maintain wildlife diversity in the region. Both the Sierra Nevada

Ecosystem Project and the Sierra Framework recommended action to protect these key habitats (SNEP 1996, USFS 2001b).

Various public and private efforts are under way in the region to restore stream habitats or to prevent further damage from livestock. The Central Modoc Resource Conservation District and the Pit River Watershed Alliance are working with land owners on stream restoration projects. The Forest Service has fenced some streams to protect the endangered Modoc sucker and other species. Rotational grazing systems that provide rest on a regular basis have been implemented to restore riparian habitats on many grazing allotments on the Modoc National Forest. The Goose Lake Fishes Working Group has been working on public and private lands to restore native fishes of the Goose Lake Basin (USFS 2000a, Yamagiwa 2005 pers. comm.).

4. Conservation Actions to Conserve and Restore Wildlife

In addition to the recommended regional actions described below, see the recommended statewide conservation actions as given in Chapter 4.

a. Federal land management agencies should more effectively manage forest, shrub, aspen, meadow, and riparian habitat to enhance ecosystems and conditions for wildlife.

Management actions may include the use of timber harvest, livestock grazing, and fire as tools to restore degraded habitats and improve ecosystem function.

b. Federal land management agencies should implement modifications to grazing management on public lands that are conducive to recovery of key habitats for restoring and conserving wildlife.

Changes in management practices should modify or discontinue livestock grazing in areas where habitats have been significantly degraded.

c. The Bureau of Land Management should update the Resource Management Plans (RMPs) to include provisions to restore and conserve wildlife diversity.

BLM has begun the process to develop RMPs for its three field offices of northeastern California. This is a good opportunity for BLM to modify guidelines for resource stewardship to restore and maintain wildlife diversity on BLM lands.

U.S. Fish and Wildlife Service, the California Department of Fish and Game, and conservation organizations should be active participants in the development of management guidelines, strategies, and practices to support wildlife diversity for incorporation into the RMPs.

The RMPs should incorporate the work agreed upon in other planning, restoration, and recovery efforts. For example, pursuant to BLM's own National Conservation Strategy for Sage-Grouse, local sage-grouse conservation planning efforts are already under way through the USFWS with multi-

agency oversight. Previously adopted bighorn sheep management guidelines should be functionally integrated into the RMPs as well.

d. Feral horse numbers should be maintained at levels that meet the constraints imposed by law, and funds should be provided for BLM and the Forest Service to meet the standards in place for the protection of meadows and riparian areas.

BLM does not have the resources to conduct horse gatherings with adequate frequency to prevent the populations of horse herds from expanding to levels that damage wildlife habitats and ecosystems. However, BLM could adequately manage horses if animals were maintained at much lower numbers in northeastern California. Studies are under way to evaluate the use of fertility control in feral horse herds (Daels and Hughes 1995). If these techniques prove effective and economically practical, they may assist efforts to maintain herds at levels that do not cause damage in the future. Until new control methods have been proven successful, however, it is necessary to reduce herd numbers to a manageable level (at achievable levels with allocated resources) to prevent degradation of wildlife habitats.

e. The Cooperative Sagebrush Steppe Restoration Initiative and the National Resource Conservation Service (NRCS) should design juniper-removal projects to benefit wildlife diversity and ecosystem health.

Working with state and federal wildlife agencies, the Cooperative Sagebrush Steppe Restoration Initiative should ensure that tree-removal projects will improve conditions for recovery of native wildlife species. Monitoring and ongoing evaluation of wildlife habitats should be an essential part of the entire initiative.

The NRCS should implement “wildlife friendly” juniper-removal guidelines and conduct post-removal monitoring to restore shrub and forb components to juniper-dominated private lands.

f. Public forest lands should be managed to maintain healthy ecosystems and wildlife diversity, including thinning to restore diverse habitats and reducing the risk of catastrophic wildfire. State and federal forest managers and wildlife agencies should work cooperatively to develop a vision for the future forest condition.

See Statewide Action f, Chapter 4.

g. Regarding forest management conservation actions, see Conservation Actions d, e, f, and g in Chapter 13, Sierra Nevada and Cascades Region.

h. Land management and wildlife agencies and conservation NGOs should develop an aquatic multispecies conservation plan for the Pit River watershed.

Various agencies and private parties involved in partnerships to implement restoration projects in selected areas of the watershed need to direct restoration projects and management efforts to the actions of greatest priority and ensure that conservation actions are not in conflict.

The Goose Lake Fishes Conservation Strategy was developed in 1996 to restore habitat for the native fishes of the Goose Lake Basin. This strategy and associated goals and objectives should be updated to reflect changes in habitat conditions throughout the Goose Lake Basin. The Pit River Watershed Alliance is actively restoring habitats in the Pit River watersheds.

Moyle and Yoshiyama (1994) have developed a five-tier approach to protect aquatic biodiversity. The tiered approach recommends action in the following order: 1) protect threatened and endangered species; 2) protect clusters of co-occurring native species; 3) create a system of Aquatic Diversity Management Areas (ADMAs), in which maintaining aquatic diversity is the first goal of management; 4) implement conservation plans at the watershed level, in which protection of aquatic biodiversity is an important goal; and 5) implement regional plans for integrated use by humans and other organisms. The aquatic multispecies conservation plan should include elements similar to this five-tiered approach. A core element should include implementing ADMAs and key projects beneficial to maintaining aquatic wildlife diversity in the region.